

U. S. Department of Energy Distributed Energy Resources and CHP Program

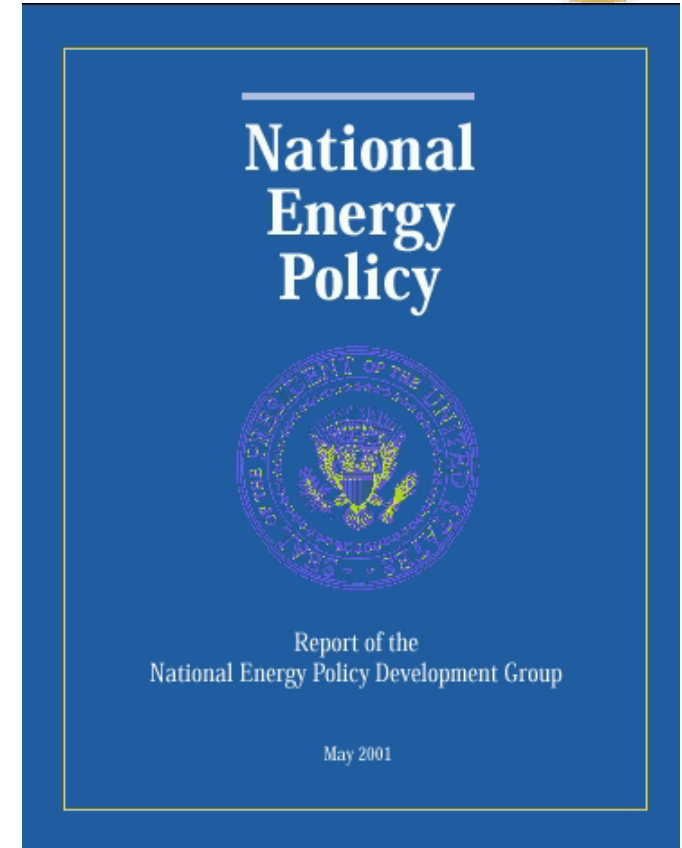
**Southeast CHP Initiative Kickoff Meeting
September 26, 2002
Atlanta, Georgia**

**Patti Garland
Oak Ridge National Laboratory
Distributed Energy Resources Program –
Washington DC Liaison**

The Federal Role



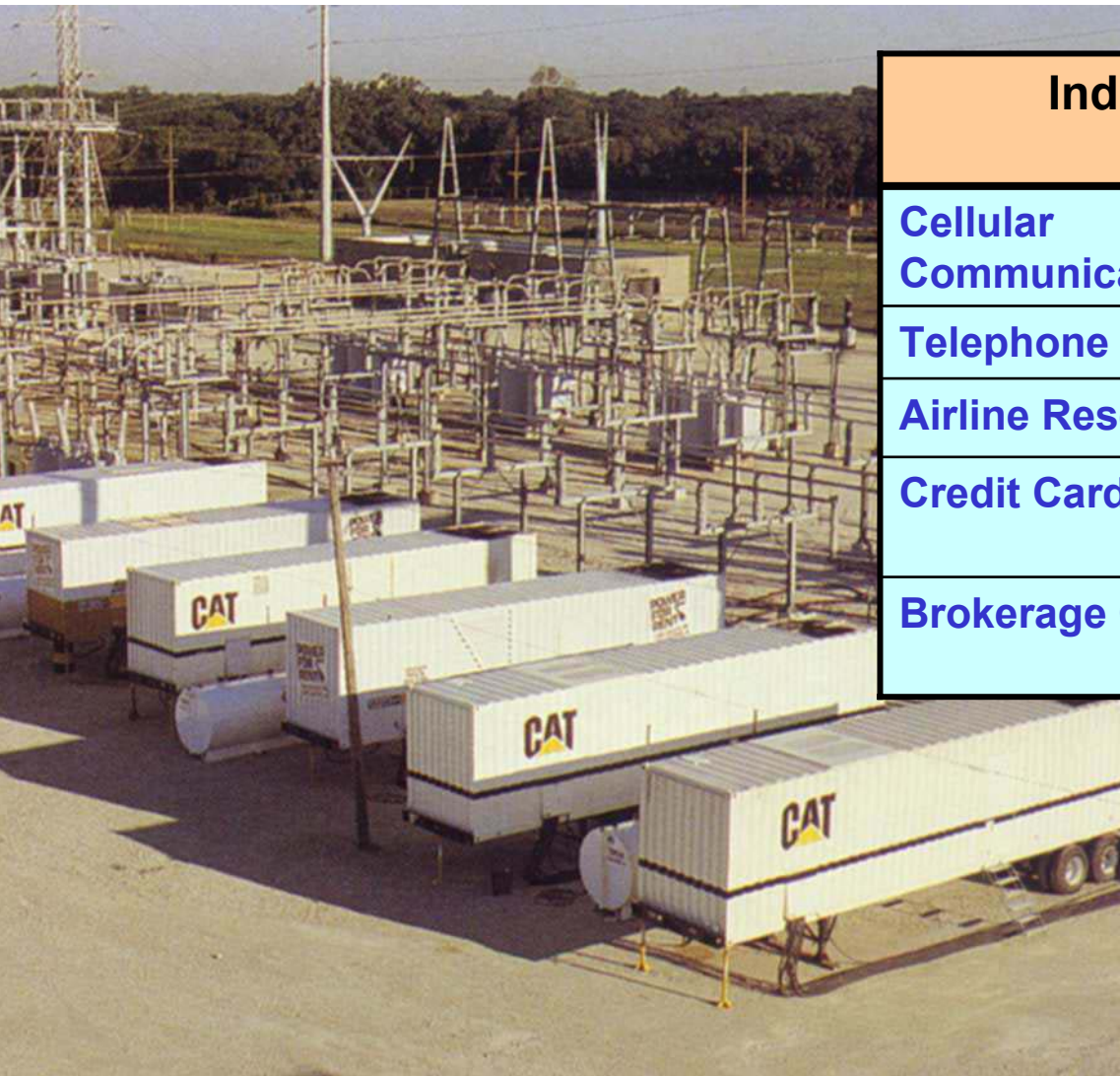
- Sustain economic growth
- Achieve energy security
- Protect the environment



Of the 105 total recommendations...

- 21 affect distributed energy
- 13 affect T&D
- 8 affect international activities
- 17 affect renewable energy

Power Reliability Costs



| Industry | Average Cost of Downtime |
|-------------------------|--------------------------|
| Cellular Communications | \$41,000 per hour* |
| Telephone Ticket Sales | \$72,000 per hour** |
| Airline Reservations | \$90,000 per hour** |
| Credit Card Operations | \$2,580,000 per hour** |
| Brokerage Operations | \$6,480,000 per hour** |

*Teleconnect Magazine

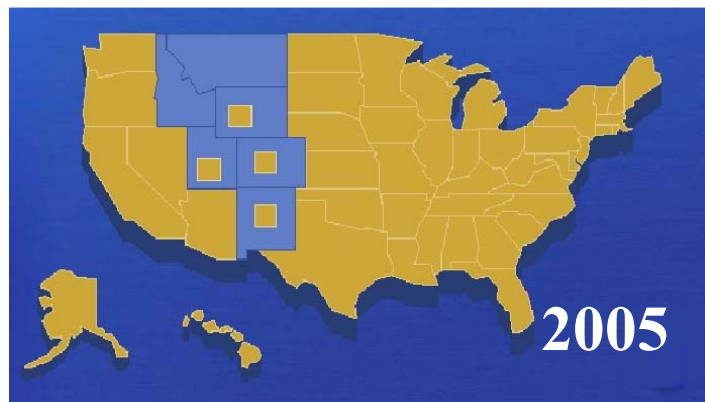
**Contingency Planning Research-1996

NOx Emissions Limits



■ > 25 ppm

■ < 5 ppm



Advantages of DER



- ▶ **Diversity of energy supplies (distributed system with fuel flexibility) enhance energy security**
- ▶ **DER Systems with increased power reliability over grid**
- ▶ **Flexible electric power grid**
- ▶ **Distributed on-site locations (ideal for remote locations with no grid infrastructure or areas with capacity constrained grid)**
- ▶ **Technologies with low emissions profiles**

Portfolio of Distributed Energy and Electric Reliability Activities



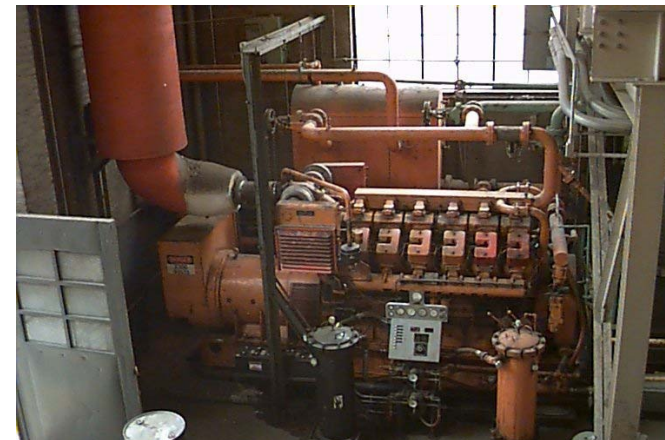
- ▶ Natural Gas Turbines
- ▶ Microturbines
- ▶ NG Reciprocating Engines
- ▶ NG-Renewable Hybrids
- ▶ High Temperature Superconductivity



- ▶ Thermally Activated Tech.
- ▶ Energy Storage
- ▶ Smart Controls
- ▶ Materials
- ▶ Low Emissions Tech



- ▶ Interconnection Standards
- ▶ Power Delivery
- ▶ Transmission Reliability
- ▶ Combined Heat and Power for Buildings and Industry
- ▶ End Use Applications



Program Portfolio



Fuel



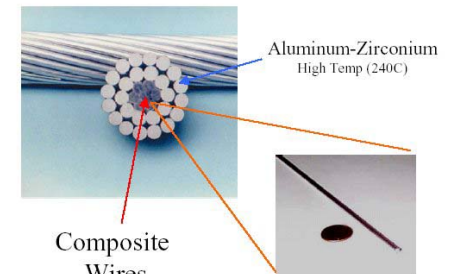
Technology Development:
Microturbines, reciprocating engines, fuel cells, materials, storage

Technology Packages:
Integrated CHP systems, chillers, desiccants

End-use Integration: Demand management, controls, sensors



Composite Conductor



Electric and Gas Integration:
Load management, sensitive loads, power electronics

Distribution System:
Load management, power parks, microgrids, storage, ups, control, DC grids

Transmission System: wire materials, tools

Distributed Gas Fired Technologies



2000

- ▶ \$900-\$1,200/kW
- ▶ 17-30% Efficiency
- ▶ Double digit ppm NO_x

Microturbines



2007

- ▶ Cost competitive with the market
- ▶ 40% Efficiency
- ▶ Single digit ppm NO_x

1997

- ▶ \$4,000-\$10,000/kW
- ▶ 80 degrees C
- ▶ Natural gas and propane fuels

Fuel Cells

2010

- ▶ \$600/kW
- ▶ 120-140 degrees C
- ▶ Multiple fuels

1992

- ▶ 29% efficiency
- ▶ Double digit NO_x
- ▶ \$600/kW

Gas Turbines

2001

- ▶ 38% Efficiency
- ▶ Single digit NO_x
- ▶ \$400/kW

2010

- ▶ Cost competitive with the market
- ▶ <5 ppm NO_x

2000

- ▶ \$300-\$400/kW
- ▶ 25-40% Efficiency
- ▶ 2-3 grams/kWh NO_x

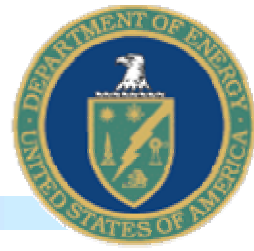
Reciprocating Engines

2007

- ▶ Cost competitive with the market
- ▶ 50% Efficiency
- ▶ < 0.15 grams/kWh NO_x



Thermally Activated Systems



2000
Individually
optimized products

- Triple-effect Chiller test – Nevada
- SEMCO/Trane desiccant in schools
- LLC “Alpha” absorption heat pump – Rocky Research
- Ammonia-Water heat pump bench unit



2010
High efficiency
systems

The U.S. CHP Challenge Goal



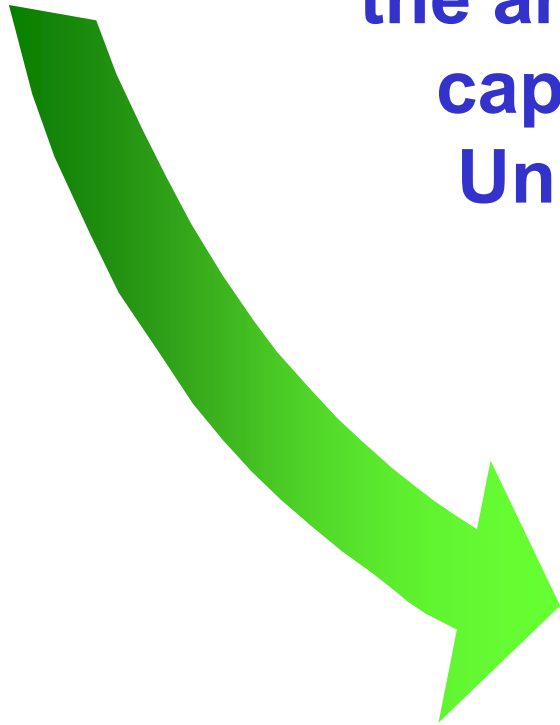
1998

46 GW

By 2010, **double**
the amount of CHP
capacity in the
United States

2010

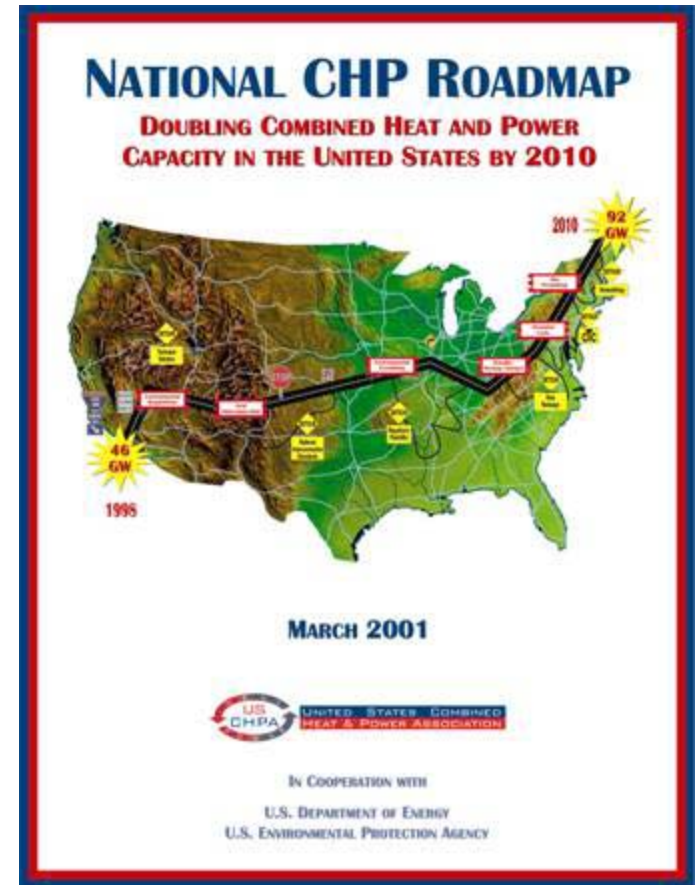
92 GW



Activities



Our CHP activities are guided by the actions identified in the National CHP Roadmap as those items required of us to meet the CHP Goal



- Raise CHP Awareness
- Eliminate Regulatory and Institutional Barriers
- Develop CHP Markets and Technologies

Application Centers



University of Illinois-Chicago: Midwest Regional CHP Applications Center

- facilitate CHP projects, technical assistance
- region-specific information, application knowledge



- ▶ Guidebook
- ▶ Lessons learned in setting up Application Center – to be used by future centers

CHP Target Markets



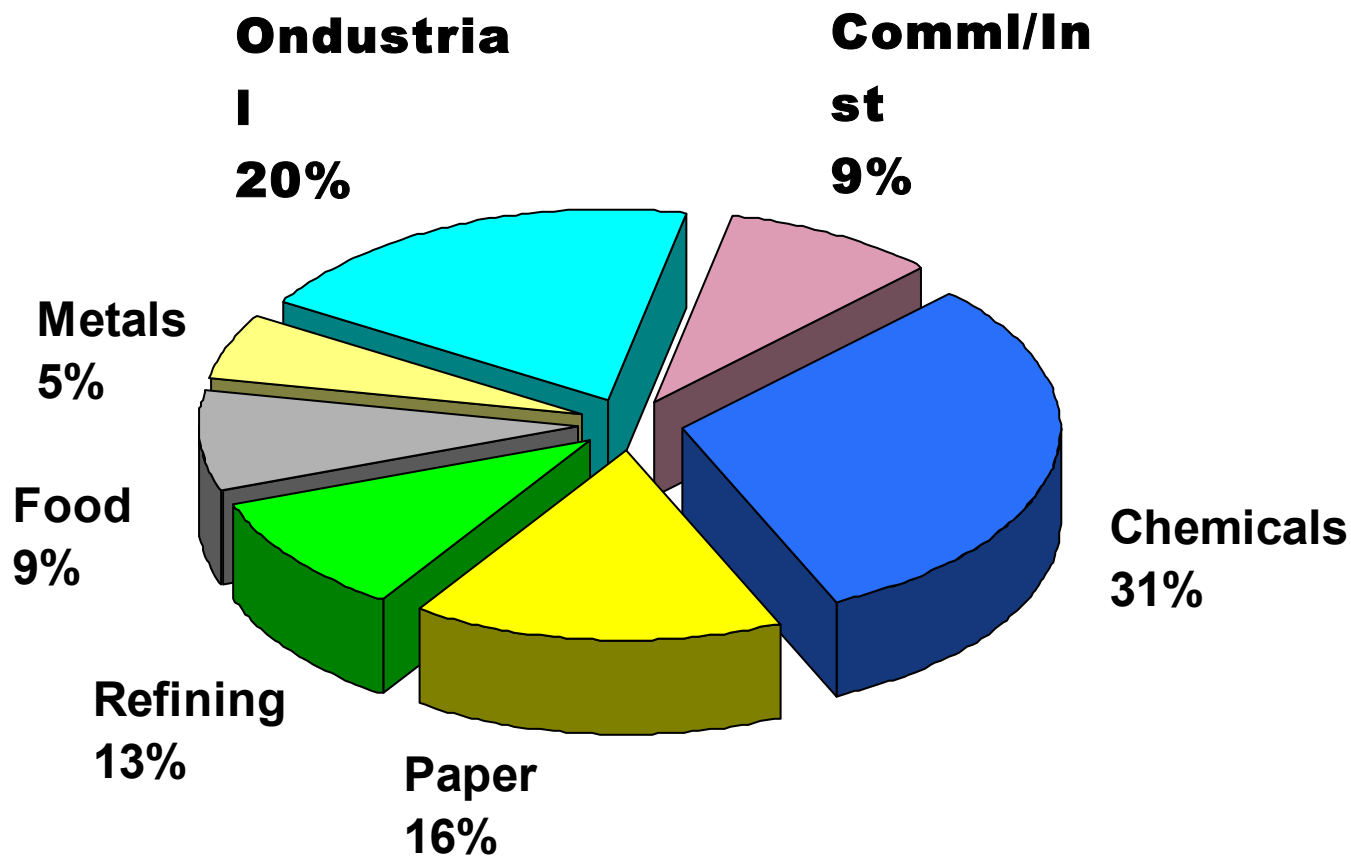
The goal is to increase each market by adding:

- ▶ 27 GW Industrial CHP
- ▶ 8 GW Building Cooling, Heating and Power (packaged systems)
- ▶ 8 GW District Energy
- ▶ 5 GW CHP in federal facilities

U.S. CHP Installations



52,800 MW – 1999

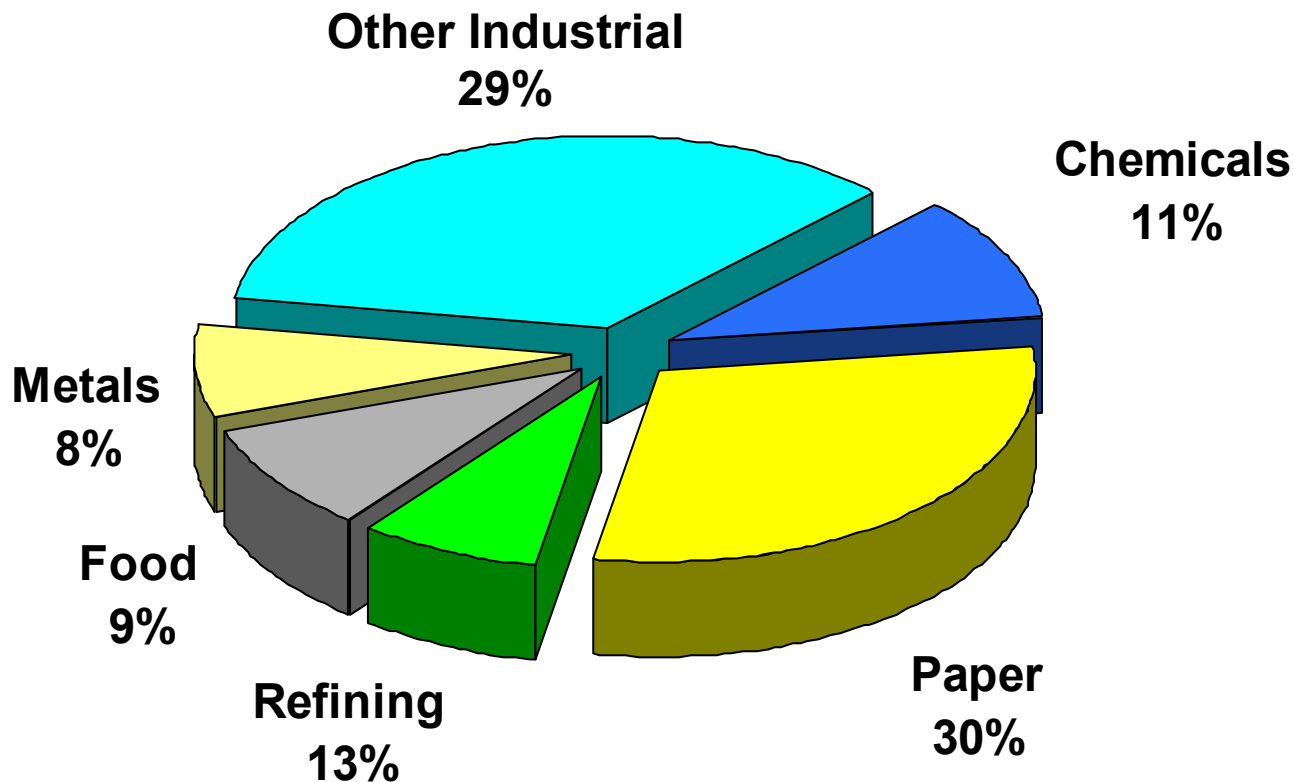


Source: U.S. DOE-EIA and Onsite-Sycom

U.S. Industrial CHP Potential



Estimated Technical CHP Potential: 88,000 MW

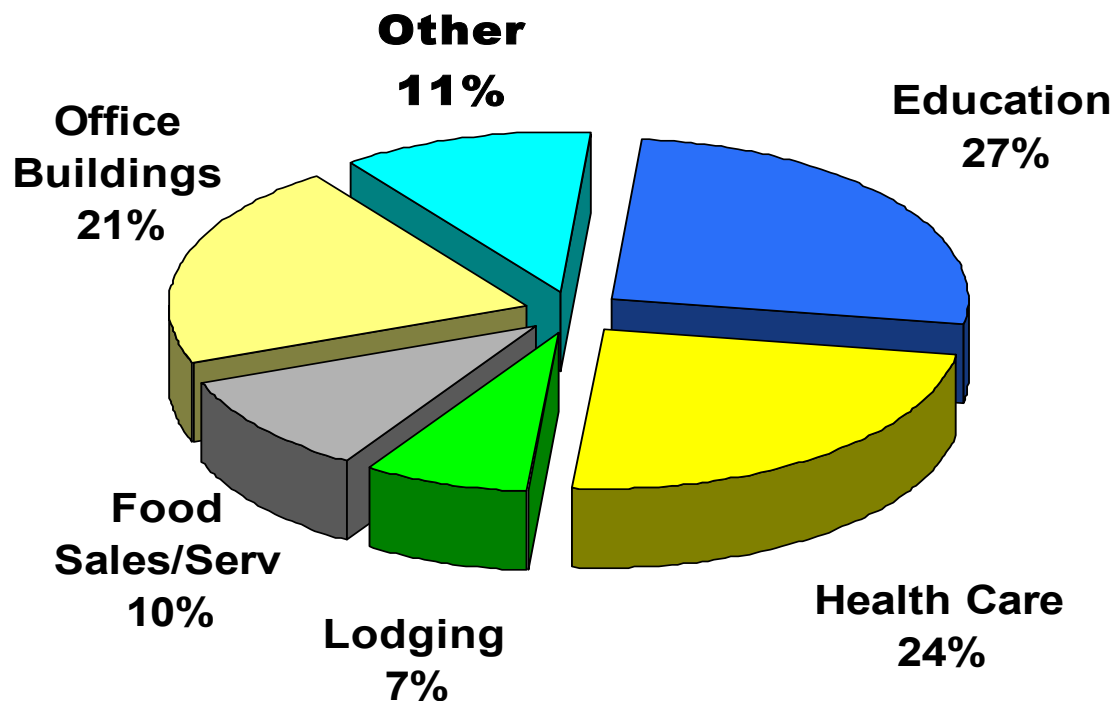


Source: U.S. DOE-EIA and Onsite Sycm

U.S. Commercial CHP Potential



Estimated Technical CHP Potential: 75,000 MW

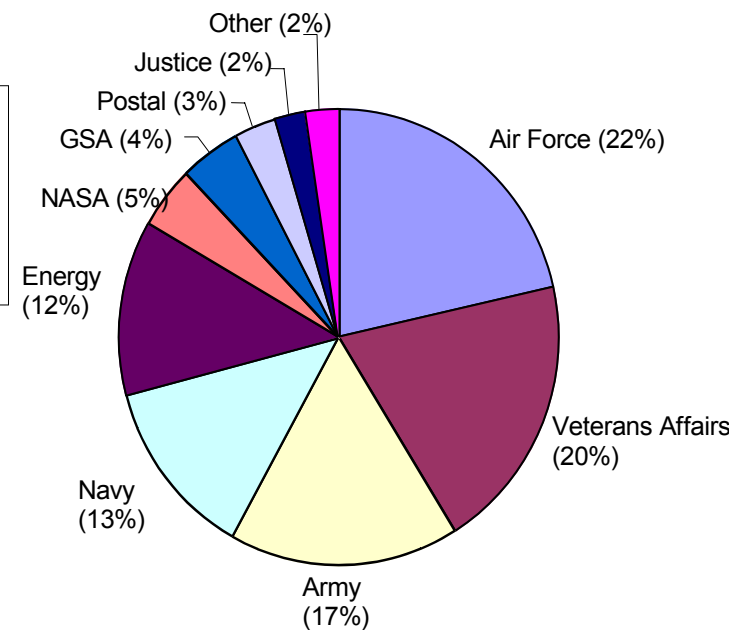
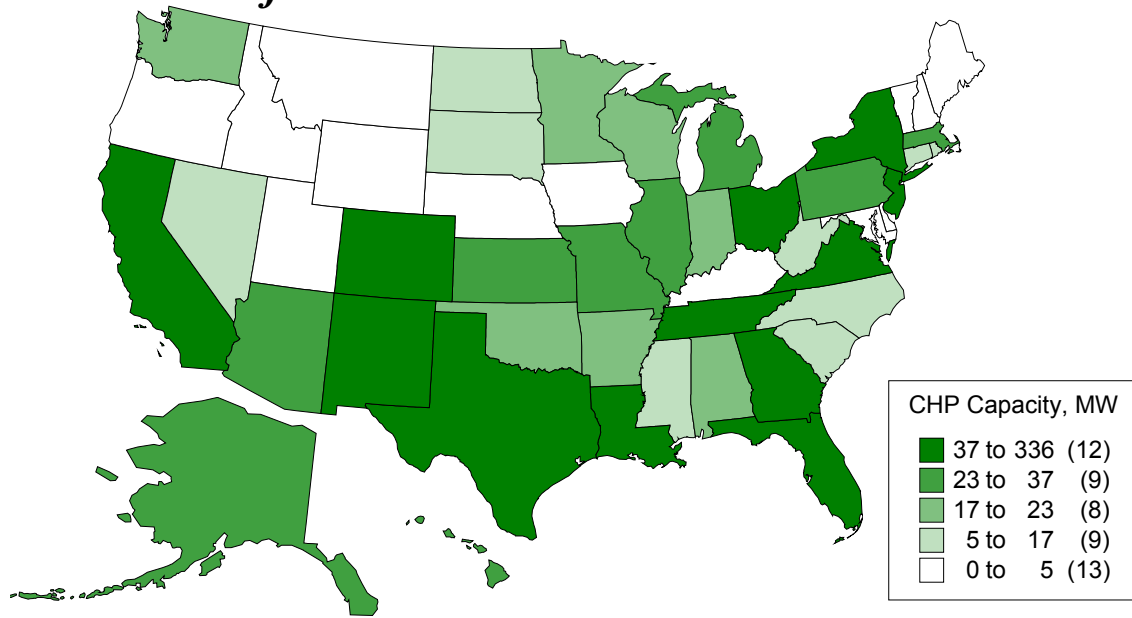


Source: U.S. DOE-EIA and Onsite-Sycom

CHP Potential in Federal Facilities 1500MW



Distribution of CHP Potential at Federal Sites--over 1500 MW



- ✓ \$170 million/year in energy cost savings
- ✓ Avg. return on investment <8 years
- ✓ 50 trillion Btu/yr of source energy savings
- ✓ 4 million metric tons/yr of avoided CO2
- ✓ Increase reliability/security representing 13% of total federal electricity purchased (2000)

Full report online at www.ornl.gov/femp/pdfs/chp_market_assess.pdf

Coordination with the U.S. Environmental Protection Agency



- ▶ Support the EPA CHP Partnership Program
- ▶ Inter-Agency Agreement to allow collaboration and joint funding
- ▶ Collaborative effort to fund Distributed Generation Emissions Characterizations
- ▶ Support EnergyStar Award for CHP

Conclusions



- DOE's CHP activities address needs from the National CHP Roadmap
- CHP is a critical component of the National Energy Plan
- CHP is integrated with most of our distributed energy efforts
- CHP increases efficiencies and reduces emissions of many distributed energy systems
- States/regions play critical role in eliminating the barriers to and developing the markets for CHP



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- **Workshops and conferences**
- **Technology planning**
- **Cost-shared RD&D**
- **Solicitation announcements**